AMENDMENTS TO THE CLAIMS

The claims in this listing will replace all prior versions, and listings, of claims in the application.

1. (Currently Amended) A direction of arrival estimator comprising:

an array antenna ~~made up of a plurality of antenna elements~~ that receives a signal as a reception signal from a communication terminal apparatus, the array antenna comprising a plurality of antenna elements;

a first correlation ~~detecting means for calculating~~ detector that calculates a cyclic correlation matrix using a ~~first~~ cycle frequency of a first modulated signal that is included in the reception signal of said array antenna;

a second correlation ~~detecting means for calculating~~ detector that calculates a cyclic correlation matrix using a ~~second~~ cycle frequency of a second modulated signal whose modulation system is different from ~~that~~ a modulation system of said first modulated signal ~~included in the reception signal of said array antenna~~; and

a direction of arrival ~~estimating means for estimating~~ estimator that estimates the directions of arrival of said first modulated signal and said second modulated signal using eigenvalues and eigenvectors of the correlation matrices calculated by said first and second correlation ~~detecting means~~ detectors.

2. (Currently Amended) The direction of arrival estimator according to claim 1, wherein, when the reception signal contains a known spread spectrum modulated signal, the first correlation ~~detecting means~~ detector calculates a cyclic correlation matrix of a spread spectrum modulated signal using a frequency decided from the chip rate of the

known spread spectrum modulated signal as the ~~first~~ cycle frequency of the first modulated signal.

3. (Currently Amended) The direction of arrival estimator according to claim 1, wherein the second correlation ~~detecting means~~ detector calculates a cyclic correlation matrix of the second modulated signal by detecting the ~~second~~ cycle frequency of the second modulated signal from the reception signal.

4. (Currently Amended) The direction of arrival estimator according to claim 2, further comprising a data ~~storing means for storing~~ storage that stores the reception signal, wherein the first correlation ~~detecting means~~ detector calculates a cyclic correlation matrix using the ~~storage~~ data ~~of~~ stored in said data ~~storing means~~ storage.

5. (Currently Amended) The direction of arrival estimator according to claim 1, wherein, when there is a plurality of eigenvalues, the direction of arrival ~~estimating means~~ estimator uses absolute values of said ~~igenvalues~~ eigenvalues to distinguish magnitudes ~~thereof~~ of the eigenvalues.

6. (Currently Amended) The direction of arrival estimator according to claim 1, wherein the second correlation ~~detecting means~~ detector detects a plurality of cyclic frequencies from the reception signal and calculates a cyclic correlation matrix of a plurality of second modulated signals.

7. (Canceled)

8. (Currently Amended) A base station apparatus equipped with a direction of arrival estimator, said direction of arrival estimator comprising:

an array antenna ~~made up of a plurality of antenna elements~~ that receives a signal as a reception signal from a communication terminal apparatus, the array antenna comprising a plurality of antenna elements;

a first correlation ~~detecting means for calculating~~ detector that calculates a cyclic correlation matrix using a ~~first~~ cycle frequency of a first modulated signal that is included in the reception signal of said array antenna;

a second correlation ~~detecting means for calculating~~ detector that calculates a cyclic correlation matrix using a ~~second~~ cycle frequency of a second modulated signal whose modulation system is different from ~~that~~ the modulation system of said first modulated signal ~~included in the reception signal of said array antenna~~; and

a direction of arrival ~~estimating means for estimating~~ estimator that estimates the directions of arrival of said first modulated signal and said second modulated signal using eigenvalues and eigenvectors of the correlation matrices calculated by said first and second correlation ~~detecting means~~ detectors.

9. (Currently Amended) A direction of arrival estimation method comprising ~~the steps of~~:

calculating a cyclic correlation matrix using a ~~first~~ cycle frequency of a first modulated signal received by an array antenna;

calculating a cyclic correlation matrix using a ~~second~~ cycle frequency of a second modulated signal whose modulation system is different from ~~that~~ the modulation system of ~~said~~ the first modulated signal ~~received by said array antenna~~; and

estimating the directions of arrival of ~~said~~ the first modulated signal and ~~said~~ the second modulated signal using eigenvalues and eigenvectors of ~~said~~ the calculated correlation matrices.

10. (New) The direction of arrival estimator according to claim 8, wherein, when the reception signal contains a known spread spectrum modulated signal, the first correlation detector calculates a cyclic correlation matrix of a spread spectrum modulated signal using a frequency decided from the chip rate of the known spread spectrum modulated signal as the cycle frequency of the first modulated signal.

11. (New) The direction of arrival estimator according to claim 8, wherein the second correlation detector calculates a cyclic correlation matrix of the second modulated signal by detecting the cycle frequency of the second modulated signal from the reception signal.

12. (New) The direction of arrival estimator according to claim 10, further comprising a data storage that stores the reception signal, wherein the first correlation detector calculates a cyclic correlation matrix using the data stored in said data storage.

13. (New) The direction of arrival estimator according to claim 8, wherein, when there is a plurality of eigenvalues, the direction of arrival estimator uses absolute values of said eigenvalues to distinguish magnitudes of the eigenvalues.

14. (New) The direction of arrival estimator according to claim 8, wherein the second correlation detector detects a plurality of cyclic frequencies from the reception signal and calculates a cyclic correlation matrix of a plurality of second modulated signals.

15. (New) The direction of arrival estimation method according to claim 9, wherein, when the reception signal contains a known spread spectrum modulated signal, the first calculation calculates a cyclic correlation matrix of a spread spectrum modulated signal using a frequency decided from the chip rate of the known spread spectrum modulated signal as the cycle frequency of the first modulated signal.

16. (New) The direction of arrival estimating method according to claim 9, wherein the second calculation calculates a cyclic correlation matrix of the second modulated signal by detecting the cycle frequency of the second modulated signal from the reception signal.

17. (New) The direction of arrival estimator according to claim 15, further comprising storing data of the reception signal, wherein the first calculation calculates a cyclic correlation matrix using the stored data.

18. (New) The direction of arrival estimator according to claim 9, wherein, when there is a plurality of eigenvalues, the estimating comprises using absolute values of the eigenvalues to distinguish magnitudes of the eigenvalues.

19. (Currently Amended) The direction of arrival estimator according to claim 9, wherein the second calculation detects a plurality of cyclic frequencies from the reception signal and calculates a cyclic correlation matrix of a plurality of second modulated signals.